

EndRun TECHNOLOGIES

2270 Northpoint Parkway, Santa Rosa, CA 95407

Date: 7/15/2011

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To: Federal Communications Commission
445 12th St., S.W.
Washington, DC 20554

From: Michael Korreng
EndRun Technologies
mkorreng@endruntechnologies.com
Tel: (707) 573-8633 Ext 308
Fax: (707) 573-8619

Comments to IB Docket No. 11-109

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Herein are EndRun Technologies' comments regarding the LightSquared Technical Working Group Report and possible issues resulting from GPS interference identified therein. EndRun Technologies designs, develops, manufactures and markets precision timing and frequency control products. Thousands of these products have been deployed in widely dispersed markets that include metrology, power utilities, banking, defense, intelligence, water districts, stock trading, satellite communications, and wired and wireless terrestrial telecommunications. EndRun Technologies were recently invited to, and did provide information at a GPS Timing workshop in support of Home Land Security. Presentation topics included the installed base of GPS timing receivers, their purpose, susceptibility to jamming or spoofing, backups to GPS, and effects of GPS failure on timing and related equipment that are dependent on GPS derived time and frequency.

Specific concerns we have regarding the reported results relate to the complete lack of any means of mitigating the effects of the Lightsquared transmissions on precision GPS applications, which include precision timing and frequency control. This conclusion was reached regardless of whether transmissions are restricted to the lower 5 or 10 MHz band. Verizon wireless indicated in the report that six GPS timing receivers were rendered inoperable during test periods with LightSquared. Verizon tested and reported on an alternate antenna that seemed to experienced no negative effects from LightSquared transmissions, however the GPS community noted that it was unable to conclude that it is a general fix. No data were presented to show that the stability of the time and frequency outputs were unaffected by using the alternate antenna.

In the report, LightSquared identified GPS receiver front end filtering to be a solution, similar to the alternate antenna used while testing with Verizon. However, this is not a simple fix that will preserve the performance and reliability that is demanded in our high-performance market. In any GPS receiver, there is a narrow bandpass filter, amplifier, and a digital signal processor required to precisely lock to the spread spectrum signal and determine an accurate solution. This solution is required for precise positioning and precise timing to calculate a three dimensional position and the offset of the receiver clock to GPS or UTC time.

EndRun Technologies has already evaluated many GPS antennas for use in our precision timing products, and has found that the poorest performers for timing stability are those incorporating multiple, cascaded narrowband filters. The added group delay resulting from the higher order filtering and the associated increased steepness of the group delay slope versus frequency over the passband cause diurnal variations in the time solution due to the wide temperature swings encountered in the typical rooftop antenna installation. In addition, since these filters must precede the low noise amplifier, the increased insertion loss of the higher order filter raises the noise floor of the system and thereby degrades weak signal reception. EndRun Technologies is unaware of the existence of bandpass filters that would mitigate the effects of LighSquared transmissions while not degrading the performance

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of our products. Even if such a solution were available, who would bear the cost of retrofitting the thousands of installations that are currently operating in the field?

EndRun Technologies is also the leading provider of precise time and frequency systems that rely on indirect GPS obtained via CDMA mobile phone transmissions. All Verizon and Sprint CDMA base stations include GPS receivers to provide time and frequency for synchronizing the transmissions for wireless communication. CDMA based clocks provided by EndRun Technologies receive these signals and extract the time from them with an accuracy of 10 microseconds. Should the Verizon or Sprint deployed GPS receivers be rendered inoperable, the EndRun Technologies deployed CDMA receivers would also become inoperable. Time provided by all EndRun Technologies clocks in the U.S. could become unavailable, since both technologies are based on GPS availability. In the event that GPS reception were jammed, many applications we currently take for granted could become unavailable, since so many of them are based on the ubiquity of GPS timing signals.

After reviewing the LightSquared Technical Working Group Report, the only mitigation that EndRun Technologies believes to be feasible is to relocate LightSquared transmissions to a different frequency band as suggested within the report.

EndRun Technologies

Michael Korreng



mkorreng@endruntechnologies.com

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Fax 707-573-8619

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